WHAT IS CLAIMED IS:

1. An interferometric microscope for making interferometric measurements of locations within an object that is in a medium, there being a mismatch between indices of refraction of said object and said medium, said microscope comprising:

a source for generating an input beam;

an interferometer which is configured to receive the input beam and generate therefrom a measurement beam, to focus the measurement beam onto a selected spot in the object and produce for that selected spot a return measurement beam, and to combine the return measurement beam and a reference beam to produce an interference beam; and

a detector system which is positioned to receive the interference beam,

wherein the return measurement beam travels along a path from the object to the detector system and wherein said interferometer includes a compensating layer of material positioned in the path of the return measurement beam, said compensating layer producing a mismatch in the index of refraction along the path of the return measurement beam that compensates for the mismatch between the indices of refraction of said object and said medium.

2. The interferometric microscope of claim 1 wherein the interferometric microscope is a confocal interferometric microscope and wherein said interferometer includes a plate positioned before the detector, said plate defining a pinhole through which the return measurement beam passes, and wherein the compensating layer is located along the path of the return measurement beam before the plate.

3. The interferometric microscope of claim 2 wherein the compensating layer is immediately adjacent to the plate.

4. The interferometric microscope of claim 2 wherein the interferometer further includes a plate located along a light path between the source and the object and defining a pinhole that is imaged onto the selected spot by the interferometer, said interferometer further including a compensating layer adjacent to the second-mentioned plate and positioned to produce a mismatch in the index of refraction along a beam path from the

second-mentioned pinhole to the object that compensates for the mismatch between the indices of refraction of said object and said medium.

5. The interferometric microscope of claim 4 wherein the first-mentioned and second-mentioned plates are the same plate, the first-mentioned and second mentioned pinholes are the same pinhole, and the first-mentioned and second-mentioned compensating layers are the same compensating layer.

6. The interferometric microscope of claim 2 wherein the plate includes an array of pinholes, the first-mentioned pinhole being one of the pinholes of the array of pinholes.

7. The interferometric microscope of claim 2 wherein the index of refraction of the object is n_0, the index of refraction of the medium immediately above the object is n_m, the index of refraction of the compensating layer is n_c, and the index of refraction of the medium through which the return measurement beam passes just before reaching the compensating layer is n_r, and wherein n_0, n_m, n_c, and n_r are real numbers and wherein $n_0 > n_m$ and $n_c < n_r$.

8. The interferometric microscope of claim 2 wherein the compensating layer provides compensation that is sufficient to obtain diffraction limited lateral and longitudinal depth resolutions within the object.

9. The interferometric microscope of claim 2 wherein the compensating layer is readily removable so that it can be replaced with a different compensating layer.

10. The interferometric microscope of claim 2 wherein the medium is air.

11. A confocal interferometry system for making interferometric measurements of locations within an object that is in a medium, there being a mismatch between indices of refraction of said object and said medium, said system comprising:

a plate defining a pinhole positioned to receive a source beam and separate the source beam into a reference beam on one side of the pinhole and a measurement beam on the other side of the pinhole;

an imaging system for imaging the pinhole onto a spot in the object so that the measurement beam is directed to said spot and produces for said spot a return measurement beam, said first imaging system also arranged to image said spot onto the pinhole so that the return measurement beam from said spot is directed back to said pinhole, wherein the pinhole combines the return measurement and reference beams to produce a combined beam; and

a detector system including a detector element that receives the combined beam,

wherein the return measurement beam travels along a corresponding path from the object to the detector system and wherein said interferometer includes a compensating layer of material positioned in the corresponding path of the return measurement beam, said compensating layer producing a mismatch in the index of refraction along the corresponding path of the return measurement beam that compensates for the mismatch between the indices of refraction of said object and said medium.

12. The confocal interferometry system of claim 11 further comprising a second imaging system that images the pinhole onto the detector element so that the combined beam is directed to the detector element.

13. The confocal interferometry system of claim 11 wherein the first imaging system is a catadioptric imaging system.

14. The interferometric microscope of claim 11 wherein the compensating layer is positioned along the corresponding path of the return measurement beam between the plate and the object.

15. The interferometric microscope of claim 14 wherein the compensating layer is near the plate.

16. The interferometric microscope of claim 14 wherein the compensating layer is up against the plate.

17. The interferometric microscope of claim 14 wherein the plate includes an array of pinholes, the first-mentioned pinhole being one of the pinholes of the array of pinholes.

18. The interferometric microscope of claim 14 wherein the index of refraction of the object is n_0, the index of refraction of the medium immediately above the object is n_m, the index of refraction of the compensating layer is n_c, and the index of refraction of the medium through which the return measurement beam passes just before reaching the compensating layer is n_r, and wherein n_0, n_m, n_c, and n_r are real numbers and wherein $n_0 > n_m$ and $n_c < n_r$.

19. The interferometric microscope of claim 14 wherein the compensating layer provides compensation that is sufficient to obtain diffraction limited lateral and longitudinal depth resolutions within the object.

20. The interferometric microscope of claim 14 wherein the compensating layer is readily removable so that it can be replaced with a different compensating layer for a different mismatch in the indices of refraction of the object and the medium.

21. The interferometric microscope of claim 14 wherein the medium is air.

22. The interferometric microscope of claim 14 wherein the first-mentioned imaging system comprises:

a beam splitter positioned to receive the measurement beam and separate that measurement beam into a transmitted portion and a reflected portion; and

a reflecting surface positioned to image the pinhole onto said spot via the beam splitter and thereby direct the measurement beam from that pinhole onto said spot.

23. The interferometric microscope of claim 22 wherein the reflecting surface is substantially concentric with a point on the object.

24. The interferometric microscope of claim 23, wherein the first-mentioned imaging system further comprises a refracting surface positioned between the object and the beam splitter to receive light rays from the object.

25. The interferometric microscope of claim 24, wherein the first reflecting surface substantially conforms to a sphere having a first radius and the refracting surface

conforms to a sphere having a second radius, wherein the first radius is greater than the second radius.

26. The interferometric microscope of claim 25, wherein first reflecting surface and the refracting surface have the same center of curvature.

27. The interferometric microscope of claim 23, wherein the first-mentioned imaging system further comprises a refracting surface positioned between the beam splitter and the pinhole to receive light rays focused by the reflecting surface.

28. The interferometric microscope of claim 22 wherein the reflecting surface is substantially concentric with the pinhole.

29. The interferometric microscope of claim 22 wherein the first-mentioned imaging system further comprises a second reflecting surface on the other side of the beam splitter from the first-mentioned reflecting surface and positioned to image the pinhole onto the spot on the object via the beam splitter.

30. A confocal interferometry system for making interferometric measurements of locations within an object that is in a medium, there being a mismatch between indices of refraction of said object and said medium, said system comprising:

an array of pinholes positioned to receive a source beam and, for each pinhole in the array of pinholes, separate the source beam into a corresponding reference beam on one side of the array of pinholes and a corresponding measurement beam on the other side of the array of pinholes;

an imaging system arranged to image the array of pinholes onto an array of spots in the object so that the corresponding measurement beam for each pinhole of the array of pinholes is directed to a different corresponding spot of the array of spots and produces for that spot a corresponding return measurement beam, said first imaging system also arranged to image the array of spots onto the array of pinholes so that the corresponding return measurement beam from each spot of the array of spots is directed back to a corresponding different pinhole in the array of pinholes, wherein for each pinhole the

pinhole array combines the return measurement and reference beams for that pinhole to produce a corresponding combined beam; and

a detector system including an array of detector elements aligned with the array of pinholes so that the corresponding combined beam for each pinhole is directed to different corresponding detector element of the array of detector elements,

wherein the return measurement beams travel along corresponding paths from the object to the detector system and wherein said interferometer includes a compensating layer of material positioned in the corresponding paths of the return measurement beams, said compensating layer producing a mismatch in the index of refraction along the corresponding paths of the return measurement beams that compensates for the mismatch between the indices of refraction of said object and said medium.

31. The confocal interferometry system of claim 30 wherein the compensating layer is adjacent to the array of pinholes.

32. The confocal interferometry system of claim 30 wherein the compensating layer is up against the array of pinholes.

33. The confocal interferometric microscope of claim 30 wherein the index of refraction of the object is n_0, the index of refraction of the medium immediately above the object is n_m, the index of refraction of the compensating layer is n_c, and the index of refraction of the medium through which the return measurement beam passes just before reaching the compensating layer is n_r, and wherein n_0, n_m, n_c, and n_r are real numbers and wherein $n_0 > n_m$ and $n_c < n_r$.

34. The confocal interferometric microscope of claim 30 wherein the compensating layer provides compensation that is sufficient to obtain diffraction limited lateral and longitudinal depth resolutions within the object.

35. The confocal interferometric microscope of claim 30 wherein the compensating layer is readily removable so that it can be replaced with a different compensating layer.

36. The confocal interferometric microscope of claim 30 wherein the medium is air.

37. A microscope for making measurements of locations within an object that is in a medium, there being a mismatch in indices of refraction between said object and said medium, said microscope comprising:

a source for generating an input beam;

a detector system;

an imaging system for focusing at least part of the input beam onto a selected spot in the object to produce a return beam; and

an imaging system for imaging the selected spot onto the detector system,

wherein the return beam travels along a path from the object to the detector assembly and wherein the second-mentioned imaging system includes a compensating layer of material positioned in the path of the return beam, said compensating layer producing a mismatch in the index of refraction along the path of the return beam that compensates for the mismatch in the indices of refraction of said object and said medium.

38. The microscope of claim 37 wherein the index of refraction of the object is n_0, the index of refraction of the medium immediately above the object is n_m, the index of refraction of the compensating layer is n_c, and the index of refraction of the medium through which the return measurement beam passes just before reaching the compensating layer is n_r, and wherein n_0, n_m, n_c, and n_r are real numbers and wherein $n_0 > n_m$ and $n_c < n_r$.

39. The microscope of claim 37 wherein the compensating layer provides compensation that is sufficient to obtain diffraction limited lateral and longitudinal depth resolutions within the object.